

REMARKS/ARGUMENTS

Reconsideration of this application in light of the above amendments and following comments is courteously solicited.

The invention as claimed in previously amended claim 1 is directed to a copper alloy consisting essentially of 58 to 62.8 wt% of copper, 0.3 to 0.5 wt% of tin, 0.03 to 0.5 wt% of silicon, at least one of 0.3 to 3.5 wt% of lead and 0.3 to 3.0 wt% of bismuth, at least one of 0.02 to 0.15 wt% of phosphorus, 0.02 to 3.0 wt% of nickel and 0.02 to 0.6 wt% of iron, the total amount of phosphorus, nickel and iron being in the range of from 0.02 to 3.0 wt%, and the balance being zinc and unavoidable impurities, which has a hardness Hv of 80.2 to 103.1, wherein a proportion of an alpha phase is 90 vol% or more, and wherein an apparent content B' of zinc in said copper alloy is in the range of from 34 to 39 wt%, said apparent content B' of zinc being expressed by the following expression:

$$B' = [(B + t_1q_1 + t_2q_2 + t_3q_3 + t_4q_4) / (A + B + t_1q_1 + t_2q_2 + t_3q_3 + t_4q_4)] \times 100$$

wherein A denotes the content (wt%) of copper and B denotes the content (wt%) of zinc, t_1 , t_2 , t_3 and t_4 denoting zinc equivalents of tin, silicon, nickel and iron, respectively ($t_1 = 2.0$, $t_2 = 10.0$, $t_3 = -1.3$, $t_4 = 0.9$), and q_1 , q_2 , q_3 and q_4 denoting the contents (wt%) of tin, silicon, nickel and iron, respectively.

The invention as claimed in newly added claim 12 is directed to a copper alloy consisting essentially of 58 to 62.8 wt% of copper, 0.3 to 0.5 wt% of tin, 0.03 to 0.5 wt% of silicon, at least one of 0.3 to 3.5 wt% of lead and 0.3 to 3.0 wt% of bismuth, at least one of 0.02 to 0.15 wt% of phosphorus, 0.02 to 3.0 wt% of nickel and 0.02 to 0.6 wt% of iron, the total amount of phosphorus, nickel and iron being in the range of from 0.02 to 3.0 wt%, and the balance being zinc and unavoidable impurities, wherein an apparent content B' of zinc in said

copper alloy is in the range of from 34 to 39 wt%, said apparent content B' of zinc being expressed by the following expression:

$$B' = [(B + t_1q_1 + t_2q_2 + t_3q_3 + t_4q_4) / (A + B + t_1q_1 + t_2q_2 + t_3q_3 + t_4q_4)] \times 100$$

wherein A denotes the content (wt%) of copper and B denotes the content (wt%) of zinc, t_1 , t_2 , t_3 and t_4 denoting zinc equivalents of tin, silicon, nickel and iron, respectively ($t_1 = 2.0$, $t_2 = 10.0$, $t_3 = -1.3$, $t_4 = 0.9$), and q_1 , q_2 , q_3 and q_4 denoting the contents (wt%) of tin, silicon, nickel and iron, respectively.

Such copper alloys have an excellent corrosion cracking resistance and an excellent dezincing resistance while maintaining excellent characteristics of conventional brasses.

Such copper alloys can be produced by a method for producing a copper alloy, the method comprising the steps of: preparing raw materials of a copper alloy consisting essentially of 58 to 62.8 wt% of copper, 0.3 to 0.5 wt% of tin, 0.03 to 0.5 wt% of silicon, at least one of 0.3 to 3.5 wt% of lead and 0.3 to 3.0 wt% of bismuth, at least one of 0.02 to 0.15 wt% of phosphorus, 0.02 to 3.0 wt% of nickel and 0.02 to 0.6 wt% of iron, the total amount of phosphorus, nickel and iron being in the range of from 0.02 to 3.0 wt%, and the balance being zinc and unavoidable impurities; casting the raw materials to form an ingot; hot working said ingot; cold or hot working the hot worked ingot; annealing the cold or hot worked ingot at a temperature of 300 to 600°C for two minutes to five hours; and cooling the annealed ingot at a cooling rate of 0.2 to 10°C/sec.

Claims 1 and 11 were rejected under 35 U.S.C. §103 as being unpatentable over US 2002/0015657 to Dong.

Dong discloses a copper-base alloy comprising 57 to 60 wt% of copper, 0.3 to 3 wt% of tin, 0.02 to 1.5 wt% of silicon, 0.5 to 3 wt% of lead, and any one of 0.02 to 0.2 wt% of phosphorus, 0.01 to 2 wt% of iron and 0.01 to 2 wt% of nickel.

Dong also discloses a copper-base alloy having a hardness Hv of 80.2 to 103.1. That is, Dong discloses a copper-base alloy having a hardness Hv of 102 as an example (Sample No. 13), and a copper-base alloy having a hardness Hv of 98 as an example (Sample No. 17). However, in copper-base alloys disclosed as all examples (Samples 1-20) by Dong, at least one of the contents of tin and silicon is beyond the range as claimed in previously amended claim 1 and newly added claim 12.

Therefore, Dong fails to disclose or suggest any copper alloy consisting essentially of 58 to 62.8 wt% of copper, 0.3 to 0.5 wt% of tin, 0.03 to 0.5 wt% of silicon, at least one of 0.3 to 3.5 wt% of lead and 0.3 to 3.0 wt% of bismuth, at least one of 0.02 to 0.15 wt% of phosphorus, 0.02 to 3.0 wt% of nickel and 0.02 to 0.6 wt% of iron, the total amount of phosphorus, nickel and iron being in the range of from 0.02 to 3.0 wt%, and the balance being zinc and unavoidable impurities, which has a hardness Hv of 80.2 to 103.1.

Furthermore, the copper-base alloys disclosed as all examples, except for Samples 13 and 17, by Dong have a hardness of 105 to 165, which is beyond the range of 80.2 to 103.1 as claimed in previously amended claim 1 and newly added claim 12.

Dong also discloses a copper-base alloy wherein the apparent content B' of zinc in the alloy is in the range of from 34 to 39 wt%. That is, Dong discloses a copper-base alloy wherein the apparent content B' of zinc in the alloy is 37.97 wt% as an example (Sample No. 7), and a copper-base alloy wherein the apparent content B' of zinc in the alloy is 37.75 wt% as an example (Sample No. 15). However, in copper-base alloys disclosed as all examples (Samples 1-20) by Dong, at least one of the contents of tin and silicon is beyond the range as claimed in previously amended claim 1 and newly added claim 12.

Therefore, Dong fails to disclose or suggest any copper alloy consisting essentially of 58 to 62.8 wt% of copper, 0.3 to 0.5 wt% of tin, 0.03 to 0.5 wt% of silicon, at least one of 0.3 to 3.5 wt% of lead and 0.3 to 3.0 wt% of bismuth, at least one of 0.02 to 0.15 wt% of phosphorus, 0.02 to 3.0 wt% of nickel and 0.02 to 0.6 wt% of iron, the total amount of phosphorus, nickel and iron being in the range of from 0.02 to 3.0 wt%, and the balance being zinc and unavoidable impurities, wherein the apparent content B' of zinc in the alloy is in the range of from 34 to 39 wt%.

Furthermore, the apparent contents B' of zinc in the copper-base alloys disclosed as all examples, except for Samples 7 and 15, by Dong are 42.27 wt% (sample 1), 43.56 wt% (sample 2), 42.72 wt% (sample 3), 43.02 wt% (sample 4), 39.80 wt% (sample 5), 39.05 wt% (sample 6), 39.66 wt% (sample 8), 42.08 wt% (sample 9), 41.06 wt% (sample 10), 41.42 wt% (sample 11), 39.62 wt% (sample 12), 39.56 wt% (sample 13), 41.37 wt% (sample 14), 43.58 wt% (sample 16), 41.15 wt% (sample 17), 51.91 wt% (sample 18), 51.97 wt% (sample 19) and 50.25 wt% (sample 20), respectively, all of which are beyond the range of 34 to 39 wt% as claimed in previously amended claim 1 and newly added claim 12.

Thus, Dong fails to disclose or suggest any copper alloy which has an excellent corrosion cracking resistance and an excellent dezincing resistance while maintaining excellent characteristics of conventional brasses.

Therefore, it would not have been obvious to one having ordinary skill in the art at the time the invention was made to make the present invention on the basis of the teaching of Dong.

Accordingly, it is believed that the amended claims patentably distinguish the invention from the prior art.

An earnest and thorough attempt has been made by the undersigned to resolve the outstanding issues in this case and place same in condition for allowance. If the Examiner has any questions or feels that a telephone or personal interview would be helpful in resolving any outstanding issues which remain in this application after consideration of this amendment, the Examiner is courteously invited to telephone the undersigned and the same would be gratefully appreciated.

It is submitted that the claims as amended herein patentably define over the art relied on by the Examiner and early allowance of same is courteously solicited.

If any fees are required in connection with this case, it is respectfully requested that they be charged to Deposit Account No. 02-0184.

Respectfully submitted,

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